The invention in which an exclusive right is claimed is defined by the following:

1. In a set of labeled probes useful for optically marking a feature of an object, said set of labeled probes including at least one labeled probe that binds to said feature and generates a signal that can be used to identify said feature, any combination of labeled probes useful for marking the feature being uniquely optically discriminable, each labeled probe in said set of labeled probes comprising:

(a) a binding element selectively binding to at least a portion of said feature; and

(b) at least one signaling component coupled to the binding element, so that:

(i) if only one binding element is bound to said feature, a plurality of signaling components that are optically discriminable, but need not be spatially discriminable are coupled to said binding element; and

(ii) if a plurality of binding elements are bound to said feature, at least one signaling component is coupled to each binding element to thereby bind a plurality of signaling components to the feature, said signaling components being optically discriminable, but not required to be spatially discriminable, when providing a unique optical signature that optically marks the feature.

2. The set of labeled probes of Claim 1, wherein the unique optical signature of the labeled probes of said set that marks the feature comprises at least one of:

(a) a spectral signature for all signaling components coupled to said at least one binding element that is selectively bound to the feature; and

(b) an intensity of a waveband of light produced by the signaling components coupled to said at least one binding element that is selectively bound to the feature.

3. The set of labeled probes of Claim 1, wherein when only one binding element is bound to said feature, said plurality of signaling components comprises at least two optically distinguishable signaling components.

4. The set of labeled probes of Claim 1, wherein when only one binding element is bound to said feature, said plurality of signaling components comprises identical signaling components, enabling said feature to be optically distinguished based on an intensity of the signal produced by the signaling components that are coupled to said feature by the binding element.

5. The set of labeled probes of Claim 1, wherein when a plurality of binding elements are bound to said feature, each of said at least one signaling component coupled to each binding element is identical, enabling said feature to be optically distinguished by an intensity of the signal produced by the signaling components that are coupled with said feature by the plurality of binding elements.

6. The set of labeled probes of Claim 1, wherein when a plurality of binding elements are bound to said feature, each of said at least one signaling component coupled to each binding element is selected from at least two different types of signaling components, such that said feature is marked by the unique optical signature that comprises a combination of the optical signatures of said at least two different signaling components.

7. The set of labeled probes of Claim 1, wherein when a plurality of binding elements are bound to said feature, each of said plurality of binding elements is identical.

8. The set of labeled probes of Claim 1, wherein when a plurality of binding elements are bound to said feature, each of said plurality of binding elements is different.

9. A set of labeled probes useful for indicating one or more features of an object, comprising:

(a) at least one binding element that selectively binds to a binding site of a feature; and

(b) a plurality of signaling components that are optically discriminable, but not required to be spatially discriminable and which together produce a signal indicative of the feature, said at least one binding element coupling to:

(i) two or more signaling components if the feature has only a single binding site to which said at least one binding element is bound; and,

(ii) at least one signaling component if the feature has a plurality of binding sites to which said at least one binding element is bound, so that at least a pair of the signaling components are coupled to the feature, providing a distinctive indication of the feature on the object.

10. The set of Claim 9, wherein the plurality of signaling components are identical, enabling a feature to be optically distinguished based upon an intensity of the signal produced by the signaling components coupled to the feature.

11. The set of Claim 9, wherein the plurality of signaling components comprise at least two different types of signaling components.

12. The set of Claim 9, wherein when said at least one binding element couples to two or more signaling components, each signaling component coupled to the same binding element is identical, enabling a feature to be optically distinguished based upon an intensity of the signal produced by the signaling components coupled to said feature.

13. The set of Claim 9, wherein when said at least one binding element couples a plurality of signaling components to a feature, said plurality of signaling components comprises at least two different types of signaling components.

14. The set of Claim 9, wherein when said at least one binding element couples at least one signaling component to a feature, said specific feature is optically indicated based on an intensity of the signal produced by said at least one signaling component that is coupled to said feature.

15. The set of Claim 9, wherein said at least one binding element comprises a plurality of identical binding elements.

16. The set of Claim 9, wherein said at least one binding element comprises a plurality of binding elements, not all of which are identical.

17. A set of labeled probes useful for indicating different features of an object, comprising:

(a) at least one binding element that binds to at least one of the different features; and

(b) at least one signaling component coupled to said at least one binding element and thus coupled to the feature to which said at least one binding element is bound, producing a uniquely discriminable optical signal, so that at least two different labeled probes of the set that bind to different features share at least one different signaling component in common, the signaling components bound to a feature not being required to be spatially discriminable.

18. The set of Claim 17, wherein each labeled probe binding to the same feature comprises the same binding element.

19. The set of Claim 17, wherein each labeled probe binding to the same feature comprises only one signaling component, such that at least two labeled probes binding to the same feature have different signaling components.

20. The set of Claim 17, wherein at least two labeled probes binding to the same feature have different binding elements.

21. A set of labeled probes useful for indicating a presence of a plurality of different features of an object, said set of labeled probes comprising:

(a) a plurality of different binding elements, each different binding element selectively binding to at least a portion of a feature of the object; and

(b) a plurality of signaling components, each different signaling component having a unique spectral signature, a number of different signaling components in said set being fewer than a number of the different binding elements in said set, such that at least two different labeled probes in the set that are capable of binding to different features share at least one different signaling component in common, labeled probes that are bound to a feature being optically discriminable, but not being required to be spatially discriminable.

22. The set of Claim 21, wherein the labeled probes of said set indicate the presence of a specific feature based on at least one of:

(a) a spectral signature of each signaling component coupled to the specific feature by at least one binding element that selectively binds to the specific feature; and

(b) an intensity of a waveband of light produced by each signaling component that is coupled to the specific feature by at least one binding element that selectively binds to the specific feature.

23. A set of probes useful for marking a plurality of different features associated with an object as a function of multiplexed optical signals that uniquely indicate each different feature, said set comprising:

a plurality of different labeled probes, each different labeled probe having a uniquely optically identifiable characteristic, a binding element that selectively binds to at least a portion of at least one feature of said plurality of different features, and at least one signaling component coupled to a feature by said binding element, each labeled probe providing a multiplexed optical signal enabling different features associated with an object to me identified, said multiplexed optical signal comprising a combination of optical signals produced by each signaling component that is coupled to the feature, said multiplexed optical signal being optically discriminable, but not required to be spatially discriminable, wherein the plurality of labeled probes comprises at least:

(a) a first labeled probe selected to bind to at least a portion of a first feature;

(b) a second labeled probe selected to bind to at least a portion of a second feature that is different than the first feature, such that said first and second labeled probes include at least one signaling component in common in the multiplexed optical signal that each produces to enable identification of the first and the second features.

24. A system for marking and identifying at least one feature associated with an object, said system comprising:

(a) a set of labeled probes useful for optically marking a feature of an object, said set of labeled probes including at least one labeled probe that binds to said feature and provides an optical signal that can be used to identify said feature, each different labeled probe in the set being uniquely optically discriminable and comprising a binding element selectively binding to at least a portion of said feature, and at least one signaling component coupled to the binding element, so that;

(i) if only one binding element is bound to said feature, a plurality of signaling components that are optically discriminable, but not spatially discriminable are coupled to said binding element; and

(ii) if a plurality of binding elements are bound to said feature, at least one signaling component is coupled to each binding element to thereby bind a plurality of signaling components to the feature, said signaling components being optically discriminable, but not spatially discriminable by the system, when providing a unique optical signature that marks the feature; and

(b) a light detector that detects the labeled probes bound to said at least one feature associated with the object, based upon the unique optical signature provided by the signaling components that are coupled to said at least one feature.

25. The system of Claim 24, wherein the light detector comprises:

(a) a collection lens disposed so that light traveling from the object passes through the collection lens and is focused along a collection path;

(b) a dispersing component that receives the light from the collection lens and disperses the light into a plurality of light beams, as a function of a plurality of different discriminable optical characteristics of the light, said plurality of different discriminable optical characteristics being indicative of each different signaling component that is coupled to said at least one feature;

(c) at least one pixilated detector;

(d) an imaging lens that focuses each of the plurality of light beams on said at least one pixilated detector, producing a respective image corresponding to each of the plurality of light beams, said at least one pixilated detector providing an output signal for each respective image, each output signal indicating each different signaling component that is coupled to said at least one feature associated with the object; and

(e) a signal processor coupled to receive the output signals from said at least one pixilated detector, said signal processor processing the output signals to determine each labeled probe that is bound to said at least one feature associated with the object.

26. The system of Claim 25, wherein said dispersing component comprises one of a dichroic filters and a prism.

27. The system of Claim 25, wherein said at least one pixilated detector comprises a time delay integration (TDI) detector.

28. The system of Claim 25, wherein said imaging lens focuses each one of said plurality of light beams onto a different region of said at least one pixilated detector.

29. The system of Claim 25, further comprising at least one light source for illuminating the object.

30. The system of Claim 24, wherein said light detector comprises:

(a) a collection lens disposed so that light traveling from the object passes through the collection lens and travels along a collection path;

(b) a plurality of light reflecting elements disposed in the collection path, each light reflecting element reflecting light of a different predefined characteristic, and passing light that does not have that predefined characteristic, the signaling components coupled to said at least one feature associated with the object determining the characteristics of light traveling along the collection path, each light reflecting element being positioned at a different location with respect to the collection path to reflect light of a specific predefined characteristic in a direction different from that of other light reflecting elements, each light reflecting element being positioned along an axis of said collection path, such that passing light not reflected by a preceding light reflecting element reaches a last light reflecting element;

(c) at least one pixilated detector disposed to receive light that has been reflected by each of the light reflecting elements, said at least one pixilated detector comprising a plurality of pixilated regions, each pixilated region producing an output signal indicating each different signaling component that is coupled to said at least one feature associated with the object; and

(d) a signal processor coupled to receive each output signal from said the plurality of regions, said signal processor processing each output signal to determine each labeled probe that is bound to said at least one feature associated with the object.

31. A system for marking and identifying one or more features of an object, said system comprising:

(a) a set of labeled probes useful for marking features of the object, each labeled probe of the set of labeled probes comprising:

(i) at least one binding element that binds to at least one feature; and

(ii) at least one signaling component coupled to said at least one binding element and thus coupled to the feature to which said at least one binding element is bound, producing a uniquely discriminable optical signal, so that at least two different labeled probes of the set that bind to different features share at least one different signaling component in common, the signaling components bound to a feature being optically discriminable, but not required to be spatially discriminable; and

(b) a cytometer for imaging the object and identifying each feature marked by at least one labeled probe of the set, by simultaneously detecting the uniquely discriminable optical signatures of any signaling components that are coupled to any feature of the object by said at least one binding element.

32. The system of Claim 31, wherein said cytometer comprises:

(a) a collection lens disposed so that light traveling from the object passes through the collection lens and is focused along a collection path;

(b) a dispersing component that receives the light from the collection lens and disperses the light into a plurality of light beams, as a function of a plurality of different discriminable characteristics of the light, said plurality of different discriminable characteristics being indicative of the signaling components coupled to any features associated with the object;

(c) at least one pixilated detector;

(d) an imaging lens that focuses each of the plurality of light beams on said at least one pixilated detector, producing a respective image corresponding to each of the plurality of light beams, said at least one pixilated detector simultaneously providing an output signal for each respective image, each output signal indicating a different one of the plurality of signaling components bound to any features associated with the object; and

(e) a signal processor coupled to receive the output signals from said at least one pixilated detector, said signal processor processing the output signals to determine if the object has one or more features labeled with any of said plurality of labeled probes, to detect said one or more features.

33. The system of Claim 31, wherein said cytometer comprises:

(a) a collection lens disposed so that light traveling from the object passes through the collection lens and travels along a collection path;

(b) a plurality of light reflecting elements disposed in the collection path, each light reflecting element reflecting light of a different predefined characteristic, and passing light that does not have that predefined characteristic, each signaling components coupled to a feature of the object determining the characteristics of light traveling along the collection path, each light reflecting element being positioned at a different location with respect to the collection path to reflect light of a specific predefined characteristic in a direction different from that of other light reflecting elements, each light reflecting element being positioned along an axis of said collection path, such that passing light not reflected by a preceding light reflecting element reaches a last light reflecting element;

(c) at least one pixilated detector disposed to receive light that has been reflected by each of the light reflecting elements, said at least one pixilated detector comprising a plurality of pixilated regions, each pixilated region producing an output signal that is indicative of a different uniquely optically discriminable characteristic of the signaling components and thus indicative of any labeled probe marking a feature on the object; and

(d) a signal processor coupled to receive the output signals from said the plurality of regions, said signal processor processing the output signals to determine if any feature is labeled with one of said plurality of labeled probes, and thus to identify any such feature.

34. A method for detecting a feature on an object using an imaging system, comprising the steps of:

(a) providing at least one labeled probe that selectively binds to said feature, wherein said at least one labeled probe comprises a binding element that selectively binds to at least a portion of said feature, and at least one optical signaling component;

(b) exposing said object to said at least one labeled probe under conditions that cause said at least one labeled probe to bind to at least a portion of said feature, if said feature is associated with said object, such that a plurality of optical signaling components become bound to said feature;

(c) collecting light from said object along a collection path;

(d) focusing the collected light to produce an image corresponding to the object, locations of labeled probes bound to a feature included in the image being optically discriminated but not spatially discriminated in the image;

(e) detecting the image to produce a signal indicative of each optical signaling component bound to the feature on the object;

(f) analyzing the signal to determine if a spectral component due to the each optical signaling component bound to said feature is present in the image, thereby establishing that the feature is associated with the object.

35. The method of Claim 34, wherein the step of exposing said object to said at least one labeled probe comprises the step of exposing said object to a labeled probe that comprises said plurality of optical signaling components, thereby binding said plurality of optical signaling components to said feature.

36. The method of Claim 35, wherein the step of exposing said object to a labeled probe comprises the step of exposing said object to a labeled probe that comprises a plurality of identical optical signaling components.

37. The method of Claim 36, wherein the step of analyzing the signal comprises the step of determining if an intensity of a waveband of light indicative of a plurality of optical signaling components is present in the image.

38. The method of Claim 35, wherein the step of exposing said object to a labeled probe comprises the step of exposing said object to a labeled probe that comprises a plurality of different optical signaling components.

39. The method of Claim 38, wherein the step of analyzing the signal comprises the step of determining if a multiplex of a spectral signature for each of the plurality of different optical signaling components is present in the image.

40. The method of Claim 35, wherein the step of exposing said object to a labeled probe that comprises the plurality of optical signaling components comprises the step of exposing said object to at least two labeled probes, each of which comprises a binding element that selectively binds to at least a portion of the feature, and each of which comprises at least one optical signaling component, thereby binding the plurality of optical signaling components to said feature.

41. The method of Claim 34, further comprising the step of dispersing the light that is traveling along the collection path into a plurality of light beams, as a function of a plurality of different discriminable characteristics of the light; wherein:

(a) the step of focusing the collected light to produce an image corresponding to the object comprises the step of focusing each of the plurality of light beams to produce a respective image corresponding to that light beam, thereby generating a plurality of images;

(b) the step of detecting the image comprises the step of responding to each of the plurality of images, producing a different signal for each of the plurality of images; and

(c) the step of analyzing the signal comprises the step of analyzing each different signal produced for each of the plurality of images to determine if indicative spectral signals produced by the plurality of optical signaling components are present in the plurality of images, thereby establishing that the feature is associated with the object.

42. A method for probing an object with labeled probes to detect if any of a plurality of specific features is associated with the object, using an imaging system that does not spatially resolve locations of the labeled probes on any specific feature, the method comprising the steps of:

(a) for each specific feature to be detected, providing at least one labeled probe that selectively couples to a corresponding specific feature, wherein each labeled probe comprises a binding element that selectively binds to at least a portion of the specific feature, and at least one optical signaling component that is bound to the specific feature by the binding element;

(b) exposing said object to said at least one labeled probe for each specific feature to be detected, under conditions that cause each labeled probe to couple to at least a portion of its corresponding specific feature, if that corresponding specific feature is associated with said object, such that at least two optical signaling components become bound to each specific feature associated with said object, each of said at least two optical signaling components that is bound to each specific feature being uniquely optically discriminable based upon a multiplex of the light from the optical signaling components, without spatially resolving a location of each labeled probe coupled to a specific feature;

(c) simultaneously detecting light from all optical signaling components associated with said object, producing a corresponding signal; and

(d) analyzing the signal to detect each optical signaling component bound to any specific feature associated with the object, thereby determining which specific feature is associated with the object.

43. The method of Claim 42, wherein the step of exposing said object to said at least one labeled probe comprises the step of exposing said object to a labeled probe having a plurality of optical signaling components, thereby binding the plurality of optical signaling components to said corresponding specific feature associated with the object.

44. The method of Claim 43, wherein the step of exposing said object to a labeled probe comprises the step of exposing said object to a labeled probe that comprises a plurality of identical optical signaling components.

45. The method of Claim 43, wherein the step of exposing said object to a labeled probe comprises the step of exposing said object to a labeled probe that comprises at least two different optical signaling components.

46. The method of Claim 43, wherein the step of exposing said object to a labeled probe comprises the step of exposing said object to at least two labeled probes selected to selectively bind to different portions of a first specific feature, each of said at least two labeled probes comprising:

(a) a binding element that selectively binds to at least a portion of the first specific feature;

(b) at least one optical signaling component that is bound by the binding element to said at least a portion of the first specific feature, so that a plurality of optical signaling components are bound to the first specific feature.

47. The method of Claim 42, wherein the step of simultaneously detecting light from all signaling components associated with said object comprising the steps of:

(a) collecting light from said object along a collection path, said light comprising a multiplexed optical signal from the optical components coupled to each feature;

(b) focusing the collected light to produce an image corresponding to the object; and

(c) detecting the image, said collected light forming the image including optical components indicative of the optical signal components that are bound to each specific feature associated with the object.

48. The method of Claim 42, wherein the step of simultaneously detecting light from all optical signaling components bound to each feature associated with said object comprises the steps of:

(a) collecting light from said object along a collection path; and

(b) dispersing the light that is traveling along the collection path into a plurality of light beams, as a function of a plurality of different discriminable characteristics of the light;

(c) focusing each of the plurality of light beams to produce a respective image corresponding to that light beam, thereby generating a plurality of images; and

(d) detecting the plurality of images.

49. The method of Claim 42, wherein each optical signaling component comprises a fluorescent dye, further comprising the step of directing sufficient energy toward said object, such that the fluorescent dye is excited to emit a fluorescent light comprising a uniquely discriminable characteristic of the optical signal component.

50. The method of Claim 42, wherein an optical signature of said plurality of optical signaling components bound to each specific feature is uniquely discriminable based on an intensity of multiplexed light from the plurality of optical signal components.

51. The method of Claim 42, wherein a spectral signature of the plurality of optical signaling components bound to a specific feature is uniquely discriminable based on its spectral composition of light from the plurality optical signal components.